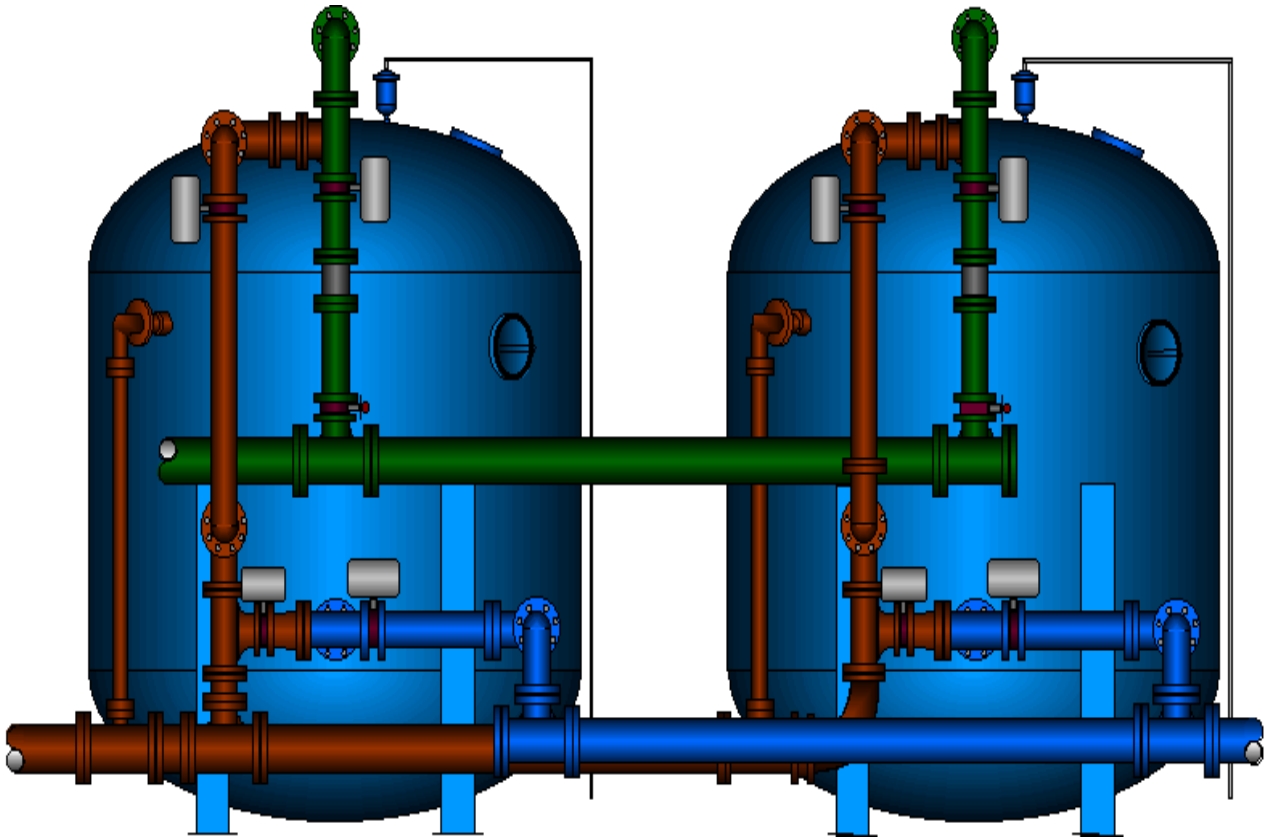

next™
Sand
Silt-Sediment-Turbidity

next-Sand



Abstract

- Media filtration is a common technique for the clarification of industrial and municipally supplied water.
- Media filtration is simple, moderately effective and relatively cheap.
- Carefully constructed layers of different media such as anthracite, sand, garnet and gravel (multimedia) provide filtration values of 12 to 20 micron at nominal flows of 3 to 10 gpm/ft2 of filter surface area (7m/h to 24m/h)

next-Sand

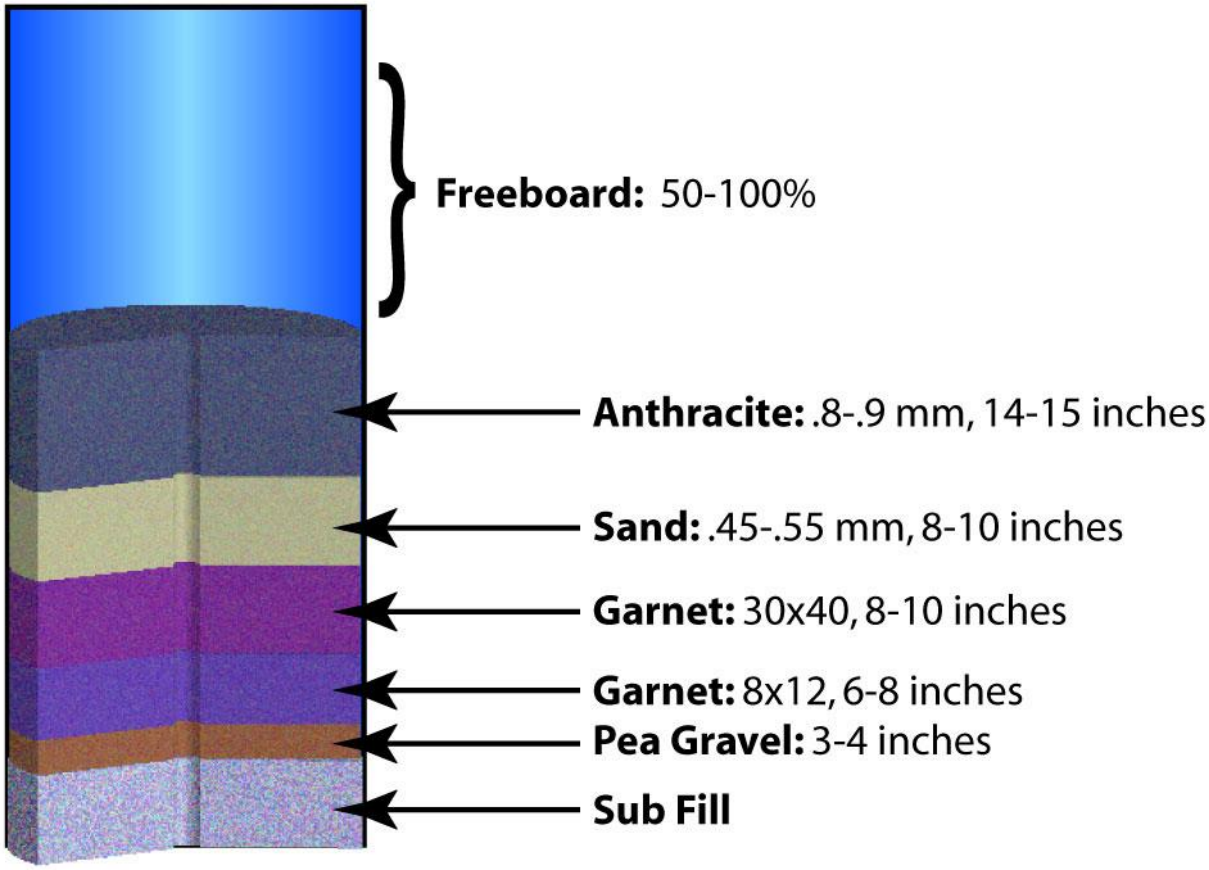
A unique processed high-purity mineral offers several compelling benefits as a replacement for multi-media.

- Improved filtration efficiency
- Higher loading capacities
- Lower pressure drop
- Higher flow rate per unit of surface area
- Lower maintenance
- Reduced water and power consumption.

Overview

- Multi-media filtration design
- Multi-media filtration performance
- Introduction to next-Sand
- next-Sand properties
- next-Sand design and performance
- Pilot studies and installations
- next-Sand advantages

MultiMedia Filter Construction

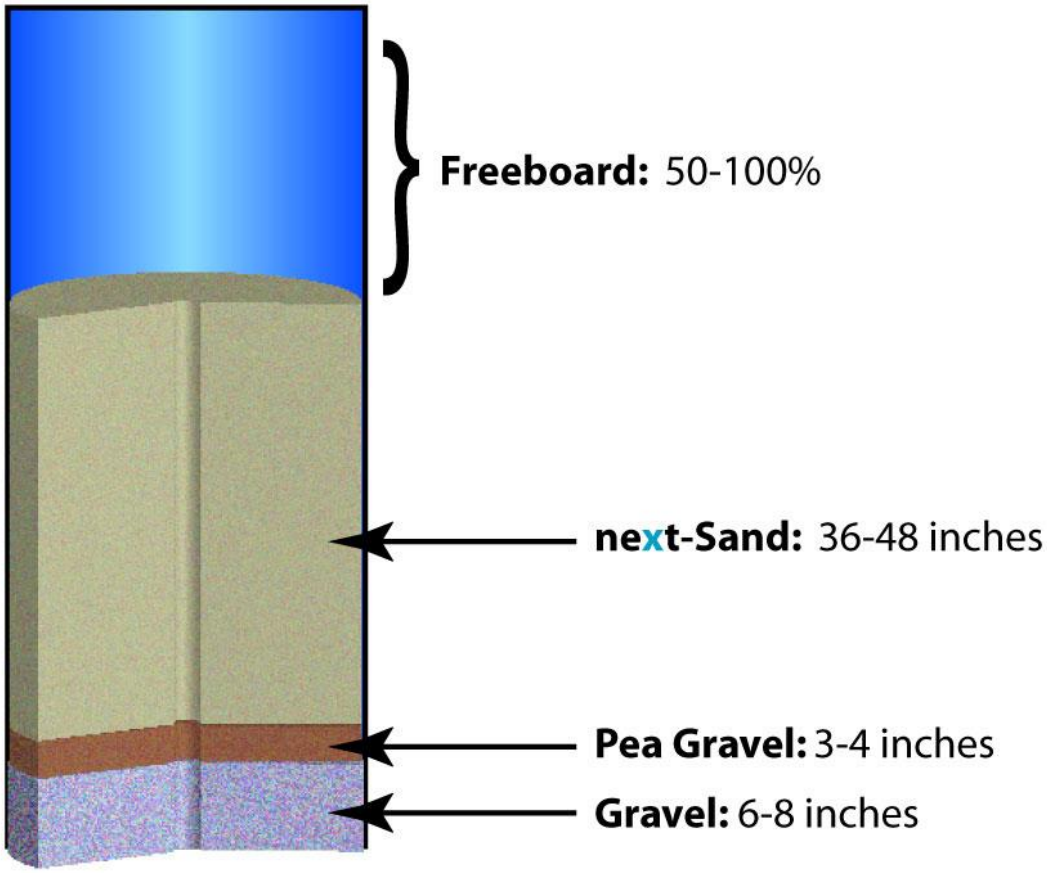


MultiMedia Filter Characteristics

- Flow rates: 3 to 10 gpm/ft2 or 11l/m to 38 l/m)
- Filtration: 12 to 20 micron
- Backwash Rate: 15 to 17 gpm/ft^2 (610-690 lpm/m^2)

- Surface Area: 0.002 m2/gm
- Average Density: 95 lbs/ft^3 (745 Kg/m^3)
- Typical bed depth: 36 to 48 inches

next-Sand Filter Construction



next-Sand Properties

- Density: 55 lbs/ft^3 430 Kg/m^3
- Media size: 14 x 40 mesh (1.4mm to 0.4 mm)
- Surface Area: 25 m2/gm
- Uniformity Coefficient: 1.7
- Surface Charge: net negative
- Bed Void Volume: 55 to 58%

next-Sand Properties

- High purity, processed mined mineral
- High hardness-minimal attrition
- Lower shipping weight vs. multimedia
- High surface area
- Hydrophilic surface
- NSF 61 listed BS6920 approved

next-Sand Performance

- Flow rates to 20 gpm/ft^2 (818 lpm/m^2)
  - 5-micron filtration (nominal)
- Twice the loading capacity of multimedia
  - Lower Delta P than multimedia
- B/W flows of 15 to 17 gpm/ft^2 (610-690 lpm/m^2)
  - Bed depth equal to fine sand and anthracite

The SDI (Silt Density Index) is a well-known parameter used in seawater reverse osmosis (SWRO) applications to objectively measure the compatibility of the incoming water with the reverse osmosis membranes. It is a general measure of particulate levels present in the water, but even more importantly, it is an excellent measure of the levels of particles which are most responsible for membrane fouling.

The test method (ASTM D4189 – 07) includes passing water through a 0.45-µm membrane filter at a constant applied gauge pressure of 207 kPa (30 psi). The plugging rate of the filter is then measured, and the SDI is calculated.

Case Study

Reverse Osmosis pretreatment for a bottled water plant

Background

Bottled water plant using multimedia pretreatment for their RO system. Client sought improved filter performance for higher efficiency and reduced waste.

Equipment

Multimedia: 48”dia. Tank, 36” bed of #16 garnet, #50 garnet, 20x40 mesh sand and anthracite.

next-Sand: 48”dia tank, 36” bed of 14x40 mesh next-Sand

Case Study

Reverse Osmosis pretreatment for a bottled water plant

Test Description

The following tests, TSS (Total Suspended Solids, Turbidity and SDI (Silt Density Index) were performed over a 5-month period by the plant operators and a consulting Chemical Engineer.

Test Results

	Feed	**MultiMedia**	next-Sand
TSS	31mg/l	23 mg/l	<5mg/l
SDI_{15}	.40	.38	.18

Case Study

Reverse Osmosis pretreatment for a bottled water plant

Conclusion

Next-Sand out-performed multi-media in every respect. An added benefit was the water savings afforded by next-Sand's reduced backwash frequency of 1/2 that of multi-media.

The high quality next-Sand filtrate allowed the Reverse Osmosis system to operate at higher capacity and higher efficiency.

Case Study

Reverse Osmosis pretreatment for a boiler feed company

Background

An electric power plant was designed and constructed with a multi-media filtration system as pretreatment for a Reverse Osmosis system. The design specification called for filtrate of the multimedia system (sand and anthracite) to produce 1500 gpm of water with an SDI of <2. The multi-media system was never able to meet this specification forcing the plant engineer to find an alternative.

Case Study

Reverse Osmosis pretreatment for a boiler feed company

Test Description

After a successful pilot test, the existing vessels were reloaded with next-Sand in early 2002. The system has consistently operated at design capacity while exceeding the water quality spec for over 3 years.

Performance data

System Flow	1500 gpm (750 gpm/vessel)	
Surface Loading	~14 gpm/ft^2	
next-Sand Performance	**Feed SDI**	**Filtrate SDI**
Initial	7	<1
24-month average	7	<1

Case Study

Reverse Osmosis pretreatment for a boiler feed company

Conclusion

next-Sand allowed the utility to operate their high volume RO on a poor quality water supply that was otherwise unusable based on conventional filtration methods.

next-Sand continues to perform well, under challenging conditions, without maintenance after more than 3 years.

Case Study

Filtration performance: SDI & Turbidity reduction, filtration efficiency

Background

Surface water, (river water with silt and clay particles following a rain event in San Antonio, Texas) was tested to compare the relative efficiency and effectiveness of next-Sand.

Equipment

Multimedia: 36” bed of #16 garnet, #50 garnet, 20x30 mesh sand and anthracite, operated at 12 gpm/ft^2.

next-Sand: 36” bed of 14x40 mesh next-Sand operated at 12 gpm/ft^2.

Case Study

Filtration performance: SDI & Turbidity reduction, filtration efficiency

Test Description

The tests were conducted over a 6-day period. Samples were taken daily.

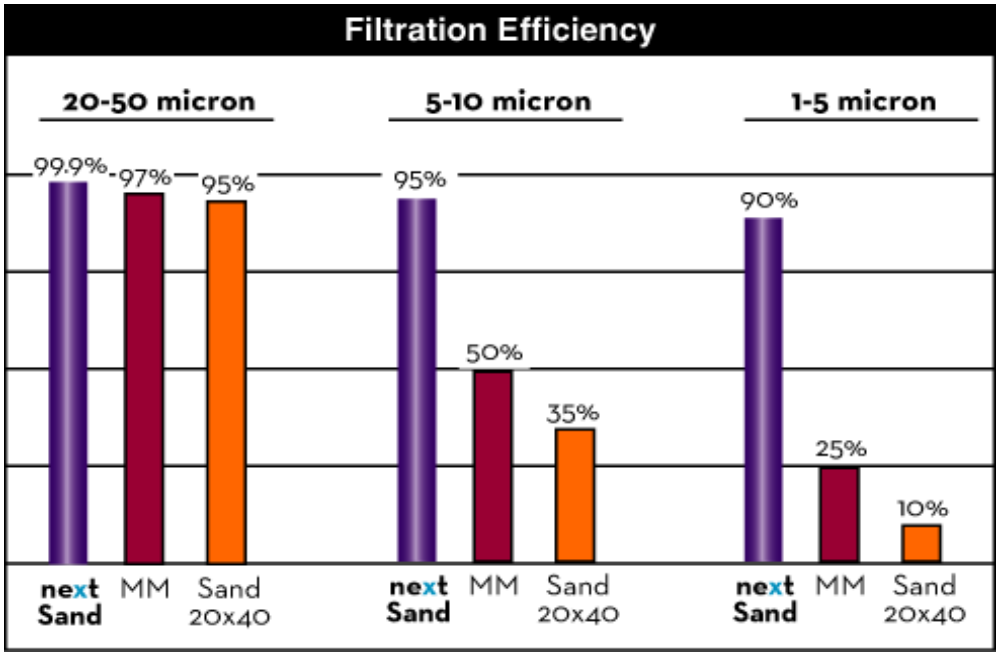
Test Results

	Feed	MultiMedia	Feed	next-Sand
Turbidity	237	171	252	90
SDI_{10}	8.1	6.1	8.9	4.1

Case Study

Filtration performance: SDI & Turbidity reduction, filtration efficiency

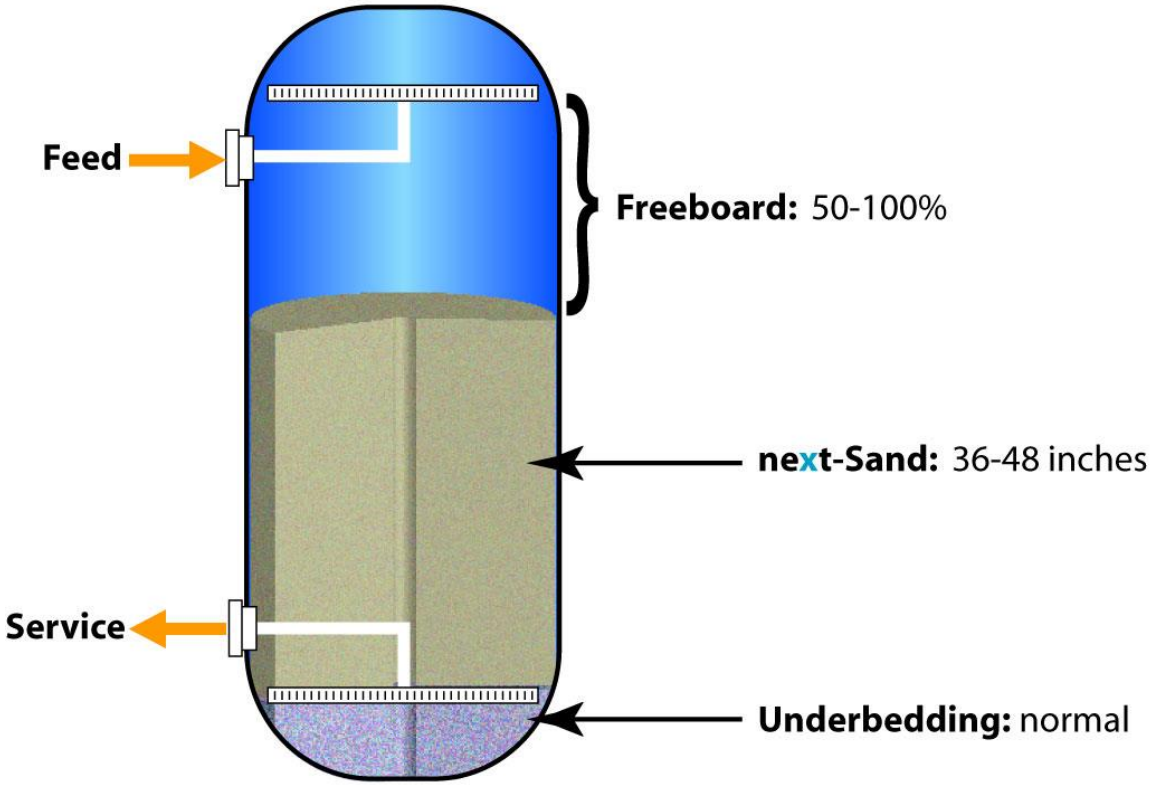
Test Results



Conclusion

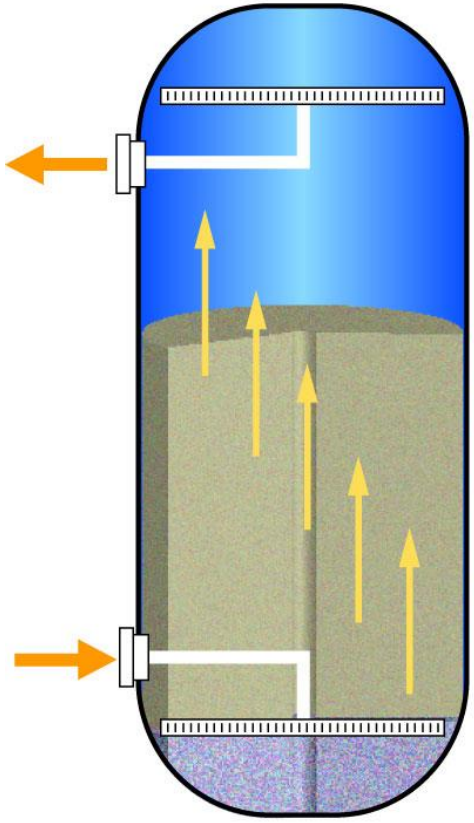
The particle analysis shows that next-Sand performs as well as or better than most 5 micron cartridge filters. next-Sand operated at 1/2 the backwash frequency indicating twice the solids loading capacity of multi-media.

next-Sand System Design



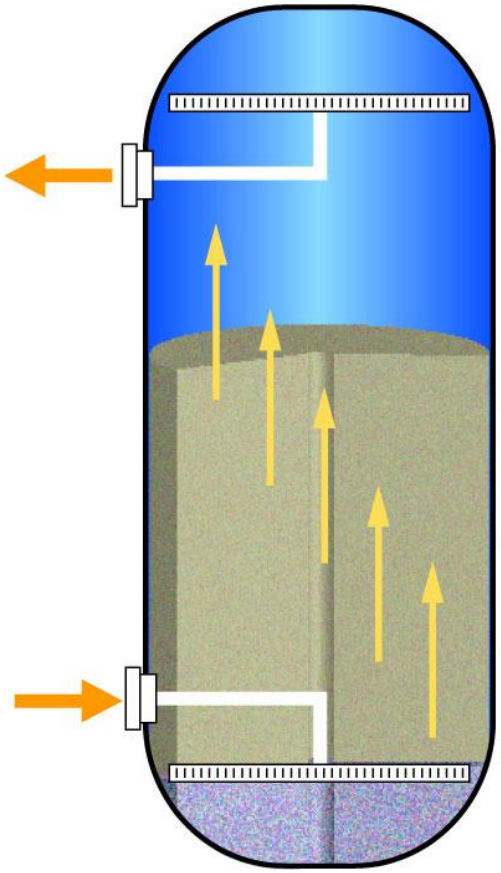
Sizing guidline: 12-20 gpm /ft2 depending on filtrate quality target and contaminant load.

next-Sand Loading and Start-up



1. Load and level underbedding.
2. Backwash 20 to 30 minutes to clean and level.
3. Load **next-Sand**
4. Backwash 20-30 minutes.
5. Settle for 15 minutes.
6. Backwash again 15 to 20 minutes.
7. Ready for service.

next-Sand Backwash



Backwash at 15 to 17 gpm/ft^2 for 10 to 15 minutes.

Optional Air Scour
Use 2-3 scfm/ft^2 air@ 90psi with 3-5 gpm/ft^2 water backwash (@77°F)

next-Sand Advantage

- Higher filtration efficiency
- Lower pressure drop
- Higher performance and higher flows
- Higher dirt loading
- Less maintenance
- Simplified inventory

next-Sand Benefits

- Less frequent backwash saves time, water, power and reduces waste volume on average 40% saving on backwash vol.
- Light weight means lower freight costs
- Higher filtration efficiency means lower turbidity
- NSF 61 listed

next-Sand

Cost comparison vs. multi-media.

- Half the weight = half the freight
- Twice the loading = half the water usage/waste – 40% saving on backwash
- Twice the flow = half the size.

Cost Comparison

500 gpm RO pretreatment

Multi-media System

- Surface Area: 100 ft^2 (online)
- Filter vessels req'd: (3) 96" diameter
- Media volume: Approx 527 ft^3 weighing approx. 50,000 lbs.
- Backwash req.: 850 gpm (6" pipe)
- Backwash freq.: Once per day
- Backwash volume: 51,000 gallons

Cost Comparison

500 gpm RO pretreatment

next-Sand System

- Surface Area: 50 ft^2 (online)
- Filter vessels req'd: (3) 66" diameter
- Media volume: Approx 249 ft^3 weighing approx. 13,725 lbs.
- Backwash req.: 400 gpm (4" pipe)
- Backwash freq.: Once per day
- Backwash volume: 24,000 gallons